

CLAIMS

1. Speed control for a multi-mode, electro-mechanical transmission including an input member coupled to a prime mover, at least one planetary gear set, at least one motor, at least one torque transfer device, a plurality of operating states and an output member, comprising:

- 5 an open loop motor torque controller operative to control a preselected transmission speed to a target speed as a predetermined function of preselected transmission torques and accelerations.

2. The speed control as claimed in claim 1 further comprising at least one closed loop effort operative to act upon a predetermined transmission speed error.

3. The speed control as claimed in claim 1 wherein said plurality of operating states includes a first state effective to operatively couple the input to the output through a first gear set, a second state effective to operatively couple the input to the output through a second gear set, a third state effective to operatively decouple the output from the transmission, and further wherein
5 when one of said first and second states is operative said preselected transmission member torques comprise input member torque and output member torque, and said preselected transmission accelerations comprise input member acceleration and output member acceleration.

4. The speed control as claimed in claim 2 wherein said plurality of operating states includes a first state effective to operatively couple the input to the output through a first gear set, a second state effective to operatively couple the input to the output through a second gear set, a third state effective to operatively decouple the output from the transmission, and further wherein
5 when one of said first and second states is operative said preselected transmission member torques comprise input member torque and output

member torque, and said preselected transmission accelerations comprise input member acceleration and output member acceleration.

5 5. The speed control as claimed in claim 1 wherein said plurality of operating states includes a first state effective to operatively couple the input to the output through a first gear set, a second state effective to operatively couple the input to the output through a second gear set, a third state effective to operatively decouple the output from the transmission, and further wherein
10 when said third state is operative said preselected transmission member torques comprise input member torque, and said preselected transmission accelerations comprise input member acceleration, output member acceleration and slip speed acceleration across at least one torque transfer device.

5 6. The speed control as claimed in claim 2 wherein said plurality of operating states includes a first state effective to operatively couple the input to the output through a first gear set, a second state effective to operatively couple the input to the output through a second gear set, a third state effective to operatively decouple the output from the transmission, and further wherein
10 when said third state is operative said preselected transmission member torques comprise input member torque, and said preselected transmission accelerations comprise input member acceleration, output member acceleration and slip speed acceleration across at least one torque transfer device.

5 7. Method for controlling transmission member speed in a multi-mode, electro-mechanical transmission including an input member coupled to a prime mover, at least one planetary gear set, at least one motor, at least one torque transfer device, a plurality of operating states and an output member, comprising:

providing a model of the transmission corresponding to an active one of said plurality of operating states, said model including controlled and uncontrolled external torques and preselected transmission accelerations;

providing values for said uncontrolled external torques into the
10 model;

providing values for said preselected transmission accelerations into the model;

solving the model for values of said controlled external torques;

and,

15 applying torque to the transmission in accordance with said values for said controlled external torques.

8. The method for controlling transmission member speed as claimed in claim 7 further comprising providing for closed loop effort acting upon at least one predetermined transmission member speed error.

9. The method for controlling transmission member speed as claimed in claim 8 wherein the closed loop effort acts upon a number of transmission member speed errors related to the number of degrees of freedom of the transmission in the active one of said plurality of said operating states.

10. The method for controlling transmission member speed as claimed in claim 8 wherein said plurality of operating states includes a first state effective to operatively couple the input to the output through a first gear set, a second state effective to operatively couple the input to the output
5 through a second gear set, a third state effective to operatively decouple the output from the transmission, the active one of said plurality of operating states is one of said first and second states and the closed loop effort acts upon input member speed error.

11. The method for controlling transmission member speed as claimed in claim 8 wherein said plurality of operating states includes a first

state effective to operatively couple the input to the output through a first gear set, a second state effective to operatively couple the input to the output
 5 through a second gear set, a third state effective to operatively decouple the output from the transmission, the active one of said plurality of operating states is said third state and the closed loop effort acts upon input member speed error and slip speed error across at least one torque transfer devices.

12. Method for controlling transmission member speed in a multi-mode, electro-mechanical transmission including an input member coupled to a prime mover, said transmission further including a pair of planetary gear sets, a pair of motors, a pair of torque transfer devices for selectively
 5 activating one of said two modes, and an output member, comprising:
 providing a mode model of the transmission corresponding to an active one of said modes, said mode model including controlled and uncontrolled external torques and preselected transmission accelerations;
 providing values for said uncontrolled external torques into the
 10 mode model;
 providing values for said preselected transmission accelerations into the mode model;
 solving the mode model for values of said controlled external torques; and,
 15 applying torque to the transmission in accordance with said values for said controlled external torques.

13. The method for controlling transmission member speed as claimed in claim 12 wherein said uncontrolled external torques comprise input and output member torques.

14. The method for controlling transmission member speed as claimed in claim 12 wherein said controlled external torques comprise motor torques.

15. The method for controlling transmission member speed as claimed in claim 13 wherein said controlled external torques comprise motor torques.

16. The method for controlling transmission member speed as claimed in claim 12 wherein said preselected transmission accelerations comprise input and output member accelerations.

17. The method for controlling transmission member speed as claimed in claim 12 wherein said uncontrolled external torques comprise input and output member torques, said controlled external torques comprise motor torques, said preselected transmission accelerations comprise input and output member accelerations, and the torque applied to the transmission in
5 accordance with said values for said controlled external torques is applied via said pair of motors.

18. The method for controlling transmission member speed as claimed in claim 12 further comprising providing a closed loop effort acting upon a predetermined transmission member speed error.

19. The method for controlling transmission member speed as claimed in claim 18 wherein said predetermined transmission member speed error comprises input member speed error.

20. The method for controlling transmission member speed as claimed in claim 12 wherein said transmission further includes a neutral state in which the output member is selectively decoupled from the transmission by simultaneous release of said pair of torque transfer devices, further
5 comprising:

providing a neutral model of the transmission corresponding to an active neutral state, said neutral model including controlled and uncontrolled external torques and preselected transmission accelerations;

providing values for said preselected transmission accelerations
 10 into the neutral model;
 solving the neutral model for values for said controlled external
 torques; and,
 applying torque to the transmission in accordance with said values
 for said controlled external torques.

21. The method for controlling transmission member speed as
 claimed in claim 20 wherein said neutral mode uncontrolled external torques
 comprise input member torques.

22. The method for controlling transmission member speed as
 claimed in claim 20 wherein said neutral mode controlled external torques
 comprise motor torques.

23. The method for controlling transmission member speed as
 claimed in claim 21 wherein said neutral mode controlled external torques
 comprise motor torques.

24. The method for controlling transmission member speed as
 claimed in claim 20 wherein said neutral mode preselected transmission
 accelerations comprise input and output member accelerations and a slip speed
 acceleration of at least one of said pair of torque transfer devices.

25. The method for controlling transmission member speed as
 claimed in claim 20 wherein said neutral mode uncontrolled external torques
 comprise input member torque, said neutral mode controlled external torques
 comprise motor torques, said neutral mode preselected transmission
 5 accelerations comprise input and output member accelerations and a slip speed
 acceleration of at least one of said pair of torque transfer devices, and the
 torque applied to the transmission in accordance with said values for said
 neutral mode controlled external torques is applied via said pair of motors.

26. The method for controlling transmission member speed as claimed in claim 20 further comprising providing for the neutral model of the transmission a closed loop effort acting upon predetermined transmission member speed errors.

27. The method for controlling transmission member speed as claimed in claim 26 wherein said predetermined transmission member speed errors comprise input member speed error and slip speed error across one of said pair of torque transfer devices.